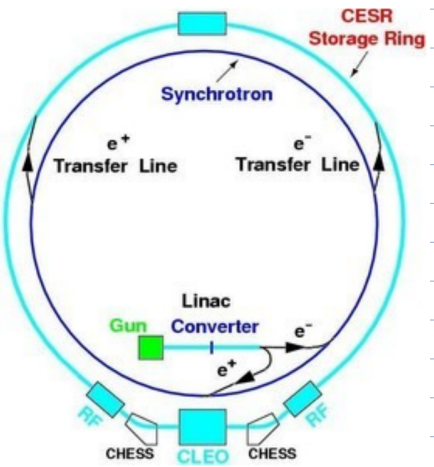
Ch 11 fun continued

ch11/s1.html Concept Q

The particles are accelerated to 6 GeV within the synchrotron using *E* fields directed tangent to the circular orbits. In order to get the electrons circulating counter-clockwise, is *E* directed clockwise or counter-clockwise?

a) clockwise

b) counter-clockwise



same $\vec{E}$ can accelerate both e^+ and e^-

ch11 tutorial B.force.particle.html

#1 $q\vec{v}\times\vec{B} = \frac{mv^2}{R}(-\hat{r})$ $\quad qvB = \frac{mv^2}{R} \Rightarrow R = \frac{mv}{qB}$

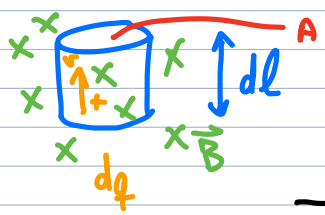
double B → halve R

#2 double v → double R

#3 R remains unchanged

#4 $T = \frac{\text{dist}}{\text{speed}} = \frac{2\pi R}{v} = \frac{2\pi R m}{qBR} = \frac{2\pi m}{qB}$ no dependance on v

A slight generalization of $q\vec{v}\times\vec{B}$ force



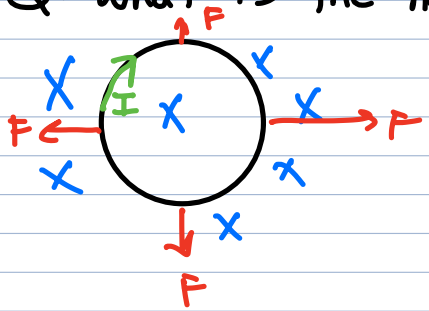
$d\vec{F} = dq\,\vec{v}\times\vec{B}\,(-\hat{\imath})$

where $dq = nA\,dl\,|e|$ $\quad n = e^-$ # density

$\rightarrow d\vec{F} = (n|e^-|vA)\,dl\,B\sin\theta\,(-\hat{\imath})$

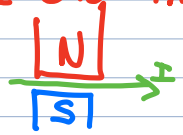
$= I\,dl\,B\sin\theta(-\hat{\imath}) \Rightarrow \boxed{d\vec{F} = I\,d\vec{l}\times\vec{B}}$

Q: What is the net force on the current loop?



no net force since F outwards everywhere

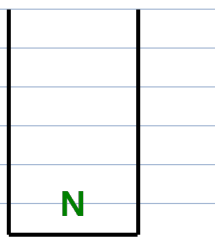
we did the demo with a magnet and current loop swing

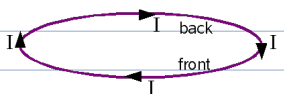


we did $I\vec{\ell} \times \vec{B}$

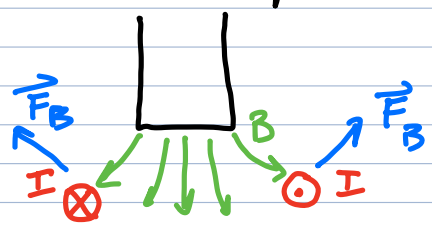
Herbert, the ever-inquisitive student, places the north pole of a bar magnet above the center of a current-carrying loop. What happens to the loop? (ignore gravity)

a) nothing
b) moves up
c) moves down
d) moves to the left
e) moves to the right
f) rotates to an upright position





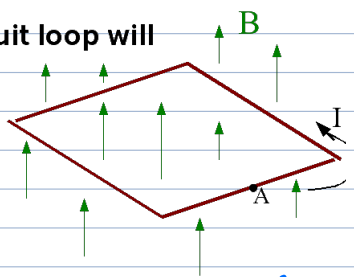
ch 11 Concept Q s2.html



Stable versus Unstable Equilibrium

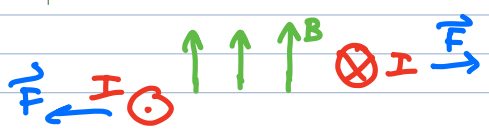
If I tap Point A from below, the circuit loop will

a) go back to its original position
b) rotate 90
c) rotate 180
d) rotate 360
e) moves to the right



ch 11 Concept Q s3.html

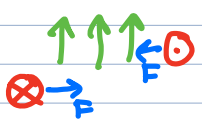
a)



What if the current direction is reversed?

Part a ⇒ a
Part b ⇒ c

b)



Q: A horizontal rod of mass m and length L is aligned in a N-S direction, carrying current I in the N direction. When a uniform $\vec{B}$ is applied to the entire rod, the $\vec{B}$ force levitates the rod.

a) Find the minimum $\vec{B}$ necessary